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RADIOTELEGRAPHY.—*The measurement of received radiotelegraphic signals.* L. W. AUSTIN, U. S. Naval Radiotelegraphic Laboratory.

(A) *A tester for rectifying contact detectors.* The measurement of radiotelegraphic signals at a great distance from the sending station is complicated by the fact that the most common type of detectors, the contact rectifiers, can not in general be depended upon to give the same sensitiveness at all times. This type of detector has a great advantage over others for quantitative work, inasmuch as it can be used with a galvanometer as well as with the telephone. Experience shows that the loudness of signal in the telephone as measured by the shunt method is exactly proportional to the deflection of a galvanometer placed in the same circuit, and in the case of nearly all types of rectifiers proportional to the square of the oscillatory current. In a former article[1] I have described a method of calibrating the detector in terms of received current in the antenna. This method, while highly satisfactory in a laboratory or large station with more or less laboratory equipment, is not suited to the use of the ordinary operator and quite impossible for use on shipboard since it involves necessarily two highly sensitive galvanometers and somewhat fragile thermoelements.

In order to overcome these difficulties I have arranged a form of detector tester which serves to establish the sensitiveness of any rectifying detector at any given time. The principle of the

[1] Bulletin, Bureau of Standards, 7: 295. 1911.

apparatus is as follows: A buzzer-driven circuit of fixed inductance and capacity has its high frequency current square measured by a sensitive H. & B. hot wire watt meter giving full scale for 0.03 watt. To the buzzer-driven circuit is coupled a second circuit with fixed condenser and two fixed inductances tuned to the buzzer circuit. This intermediate circuit is introduced to prevent any direct effect of the buzzer on the detector. To this second circuit is coupled with a fixed coupling a third circuit consisting of a fixed inductance, stopping condenser and the detector to be tested. A Paul microammeter of about 250 ohms resistance, giving two divisions per microampere, is placed around the stopping condenser in series with the telephones regularly used with the detector.[2] The plan of the apparatus is shown in the figure, and the value of the inductance and capacities are shown in the table.

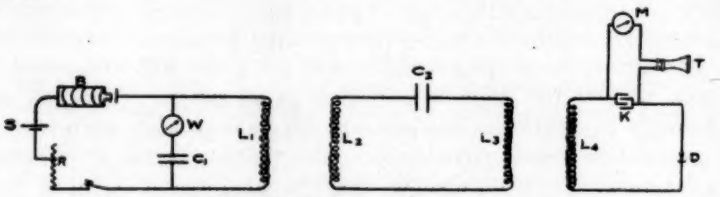

Fig. 1. Radio-Detector Tester

B, Ericsson buzzer, 3 ohms.
S, 1 or 2 dry cells.
R, Variable resistance.
Λ = 2000 m.[3]
$L_1 = L_2 = L_3 = L_4$ Inductance = 0.4 m.h.
C_1, Fixed air condenser = 0.0028 m.f.
C_2, Fixed air condenser = 0.0014 m.f.
W, H. & B. hot wire wattmeter, 6.5 ohms.
M, Paul Microammeter, 250 ohms.
T, Telephones 2500 ohms.
D, Detector under test.

[2] The object of placing the telephones in the circuit is to ensure an approximately normal amount of resistance in series with the detector.

[3] Shorter wave lengths do not give enough energy to be measured on the wattmeter without using too much current thru the buzzer contact.

It will be seen that this detector tester differs from others in that the wave lengths, inductances, coupling, etc., are fixed and the test becomes simply the measurement of the response of the detector to a definite amount of high frequency excitation.

The sensitiveness of the detector is determined by observing the deflection on the microammeter corresponding to a reading of 0.005 watt on the wattmeter in the buzzer circuit. The ratio of wattmeter to microammeter reading may be expressed in terms of energy required to produce a response, arbitrarily taken as the least audible signal under average conditions. This energy calibration of the detector tester is made once for all by means of a detector calibrated immediately before by the thermoelement and galvanometer method.

For example, a certain detector, which by the method already mentioned[4] has been shown to require 3.1×10^{-9} watts to produce an audible sound in our standard laboratory telephones, produces when placed in the tester a deflection of ten divisions on the microammeter for a reading of 0.005 watt on the buzzer circuit wattmeter. Now, if some other detector be placed in the tester and gives five divisions for the same wattmeter reading, it is half as sensitive as the first and requires 6.2×10^{-9} watts for audibility in the standard telephones.

Experience has shown that the amount of energy required to produce a certain strength of signal from the detector is independent of the wave length and approximately independent of the spark frequency.[5] It has also been found that, when the detector circuit is coupled to the antenna just closely enough to produce maximum strength of signal, the energy is equally divided between the antenna and the detector circuit.[6] From this it follows that, if we know the energy in the detector, we have a measure of the received energy and, if the total resistance of the antenna, including that introduced by the coupled detector circuit be known, and the effective height of the antenna be also known,[7] from the

[4] Bulletin, Bureau of Standards, 7: 295. 1911.

[5] Entirely so for galvanometer deflection.

[6] Bulletin, Bureau of Standards 7: 301, 1911.

[7] T. Ruedenberg, Ann. d. Phys. 25: 446. 1908. Journal of the Washington Academy, 1: 275. 1911.

strength of signal or galvanometer deflection we can determine at once the intensity of the electric field at the receiving point.

Some detectors, for example the perikon,[8] can not be calibrated with the microammeter as their adjustment is disturbed by the amount of high frequency energy required to make a suitable deflection. For such detectors the following method of calibration may be used. The middle circuit may be opened and leads of about 50 cm. in length brought out to a coil of two or three turns of wire wound on a hard rubber core. On this same core, at a sufficient distance from the first coil to give proper coupling, a second coil of say 0.1 m.h. is wound, and to this coil is connected the detector to be tested with suitable stopping condenser and telephones with an audibility meter of the type described in this paper shunted across them. In this case the audibility meter takes the place of the microammeter of the first method and the coupling should be adjusted and made permanent for an audibility of about 100 times with an average detector for a wattmeter reading of 0.005 watt.

(B) *An audibility meter.* For the determination of the loudness of the signals in the telephone by the shunted telephone method, the most convenient form of shunt resistance box is one in which all the resistances are controlled by a single dial arm. In general, thirty to forty studs are sufficient, giving different degrees of audibility varying by approximately 20 per cent. The exact inductive resistance of the telephone, of course, varies with the spark frequency, and to a lesser extent with the capacity used in the stopping condenser which seems to affect the wave form of the rectified pulses. The inductive resistance of modern 2500 ohm telephones used with a stopping condenser of not more than 0.02 microfarad at a thousand sparks per second, is approximately 5000 ohms. With the old fashioned low frequency spark, the inductive resistance differs very little from the direct current resistance. If the resistance box is made for use with a definite telephone and a definite spark frequency it may be very conveniently marked in audibility instead of in resistance.

[8] The silicon on the contrary is very stable.

The following are the values of the resistance units and corresponding audibility for 2500 ohm telephones at 1000 sparks per second in an audibility meter designed at my suggestion by G. W. Pickard:

AUDIBILITY	RESISTANCE	AUDIBILITY	RESISTANCE
	ohms		*ohms*
2	5000	100	51
2.5	3300	120	42
3	2500	160	31
4	1650	200	25
5	1250	250	20
6	1000	300	16.7
8	720	400	12.5
10	555	500	10.0
12	455	600	8.4
16	334	800	6.3
20	264	1000	5.0
25	208	1500	3.3
30	174	2000	2.5
40	128	3000	1.7
50	102	4000	1.3
60	85	5000	1.0
80	63		

MINERALOGY.—*A danger to be guarded against in making mineral separations by means of heavy solutions.* W. F. HILLEBRAND, Bureau of Standards. To appear in the American Journal of Science and the Zeitschr. Kryst. Mineral.

The occasional action of heavy solutions on minerals is usually evident to the eye. When using Thoulet's solution of mercury and potassium iodides to separate from its gangue a carnotite from Paradox Valley, Montrose County, Colorado, carrying calcium instead of potassium (probably identical with the tuyamunite of Nenadkevich,[1] the author found that the calcium of the mineral was largely, if not wholly, displaced by potassium, without visible alteration, altho Mr. H. E. Merwin observed a large decrease in the optic axial angle to have resulted. The observation shows how important it is to assure oneself, when using heavy solutions, that such chemical changes are not incurred. Question

[1] Bull. Acad. Sci. St. Petersburg, 1912, p. 945.

arises as to the validity of some formulas that have been assigned to minerals which have been separated by heavy solutions.

The calcium carnotite will be described in detail by Mr. Merwin and the author in a later paper.

MINERALOGY.—*Two varieties of calciovolborthite* (?) *from eastern Utah.* W. F. HILLEBRAND, Bureau of Standards, and H. E. MERWIN, Geophysical Laboratory. To appear in the American Journal of Science and the Zeitschr. Kryst. Mineral.

Descriptions in some detail will appear in the above named journals of two hydrous minerals, one essentially a vanadate of copper, the other an arsenovanadate of copper and calcium. The minerals were briefly mentioned by J. M. Boutwell in Bulletin 260 of the U. S. Geological Survey a number of years ago, but analyses were not published. Better material not being forthcoming the analyses are now put on record, together with results of recent optical study. For the present both minerals are referred referred to calciovolborthite, since the molecular ratios show closer relationship to that imperfectly described species than to any other. One variety is yellow green, with little arsenic, the other, highly arsenical, is greenish yellow. The latter is pseudomorphic after the former. The locality of occurrence is Richardson, in the canyon of the Grand River, Utah.

BOTANY.—*Ivory palms in Panama.* O. F. COOK, Bureau of Plant Industry.

New materials for the study of the ivory palms (Phytelephantaceae) have become available in the collections of economic plants secured in Panama in 1911–12 by Prof. H. Pittier of the United States Department of Agriculture. The series is more extensive than any obtained by previous explorers and throws light on the geographical distribution, morphology and classification of this long-neglected family. It may be that special students and collectors of palms have felt at liberty to neglect the ivory plants because some botanists have denied that Phytele-

phas is really a palm, tho there is no adequate reason for such a separation. The nearest relatives of Phytelephas are to be found in other American families, such as the Cocaceae and Manicariaceae, whose status as true palms has never been questioned.[1]

GEOGRAPHICAL DISTRIBUTION OF IVORY PALMS

The new specimens from Panama were obtained in four different localities; two near the Caribbean Coast, one near the middle of the Isthmus and one near the Pacific Coast. In each case a different species was secured, and all four of the species appear to be different from two others previously represented in the Economic Herbarium of the Department of Agriculture. In addition to the places where specimens were collected Professor Pittier heard reports of the existence of ivory palms to the north of the Isthmus, and this information is substantiated by Dr. A. E. Heighway of Bocas Del Toro, Panama, who states that ivory palms exist in small numbers in several places, most of them back a few miles from the coast, along the foothills. Thus it appears that the geographical distribution of the ivory palms extends beyond the Isthmus, so that the family Phytelephantaceae must be included in the flora of North America.

The genus Phytelephas was based originally on two Peruvian species, from the eastern slopes of the Andes. One species has been described from the Pacific coast of Ecuador and another from the Magdalena Valley of Columbia. Thus only four definitely localized species are known from South America to six in the region of Panama. The existence of so many local species in the narrow limits of the Isthmus makes it seem probable that more careful study of the South American members of the group will result in the discovery of a much larger number of specific forms. Even on general biological grounds it would not be expected that species with such large heavy seeds would retain their continuity over wide areas of distribution. The first requirement for an adequate taxonomic treatment of the group is to

[1] O. F. Cook, Relationships of the ivory palms. Contributions U. S. National Herbarium **13**: 133. 1910.

learn the characters which enable the species to be distinguished. In this respect the materials from Panama are of special value for they show several new lines of specialization not previously employed in the diagnosis of species.

NEW CHARACTERS IN IVORY PALMS

External sculpture of fruits. The species are all alike in having the external shell of the fruit divided into raised polygonal areas, each bearing a pyramidal tubercle or spine, but the areas are larger in some species than in others and have larger or more robust spines. In coarsely sculptured species the spines attain a length of about 2 cm.; in other species they are only half as long.

Cortical fibers. These form a lining of close-set bristles on the inner wall of the external shell of the fruit, to which they are firmly attached. Indeed, the shell seems to be formed by a progressive hardening of the corky tissue in which the bases of the fibers are embedded. The species differ notably in the development of the cortical fibers, some having only short weak fibers and others long stiff fibers. In most cases the fibers are about as long as the external spines, but they may be longer or shorter.

Pulp fibers. The space between the cortical fibers and the true mesocarp fibers that form a coating around the nuts is occupied at first by a fleshy pulp. In some species the pulp seems to be entirely fleshy, so that only an empty space is left inside the cortical lining after the pulp has disappeared. In other species there is an open framework of loosely connected fibers, especially near the base of the fruit.

Mesocarp fibers. In addition to the pulp fibers there is a complete fibrous sheath around each of the nuts, not unlike the mesocarp of some of the cocoid palms, except that the fibers are not attached to the shell of the nut. Some species of ivory palms have the mesocarp fibers rather coarse and stiff, while in others they are very fine and thin and are compacted into a fabric, tough in some cases and brittle in others. Finally there are cases where the mesocarp fibers are so slightly developed that no coherent layer is formed and the dried pulp breaks away from the surface of the nuts in angular scales. The mesocarp sheath may

be closely adherent to the endocarp or shell of the nut, or free and readily separable from the nut. One species has the sheath much larger than the nut as though separated in the fresh state by a layer of pulp.

Style. In most of the species the style disappears in advance of the maturity of the fruit, but one of the new species from Panama has a persistent woody style.

Columella. Most of the species have a short column or bundle of compacted fibers suspended from the center of the cortex of the fruit in the position of a placenta. The species with the persistent style also has a more specialized, persistent columella extending down between the nuts nearly to the position of the hilum.

Hilum. The hilum is very prominent in some species and nearly flat in others. The shape differs from long oval or elliptical to nearly round. The fibrovascular pits are irregular and scattered over the surface of the hilum in some species while in others the pits are nearly round and confined to a relatively small area in the middle of the hilum.

Adhilum. This name is applied to a peculiar specialization of the shell of the nut to form a distinct process or spine at the upper angle of the margin of the aperture, close to the hilum. In some species the adhilum is a small rounded prominence or angular tooth, but in other cases it is developed into a slender acicular spine. The adhilum is formed of the same hard material as the shell of the nut, but is so brittle that it is usually broken off in removing the mesocarp, which may explain why it has not been noticed before.

Seed coats. The shell of the nut has a lining of fine fibrous material through which the branches of the raphe are distributed. In some species this lining is free from the true seed coat and in others completely united with it. In the former case the branches of the raphe are not exposed, but appear as raised veins on the lining of the shell. In the latter case the branches of the raphe are exposed on the kernel as it comes from the shell, because the fibrous lining is torn apart into two irregularly separated layers, one adherent to the inner surface of the shell, the other to the true seed coat.

DIAGNOSES OF NEW SPECIES FROM PANAMA

Phytelephas pittieri. Trunk erect, attaining a height of about 8 meters, with a diameter of about 25 cm.; leaves about 12 with short petioles and about 70 pairs of pinnae equally spaced along the rachis; male inflorescence cylindrical, about 1.20 meters long; male flowers with 300–400 stamens, fruits 8–9 in a head, with large external spines. Collected at Puerto Obaldia, Panama, August, 1911, by H. Pittier (No. 4323); type in U. S. National Herbarium, No. 716082.

Phytelephas cornutus. Trunk decumbent, creeping by numerous roots; leaves about 20, with about 90 pairs of equally spaced pinnae; fruits 5–6 in a head, with 6–7 nuts in each fruit; cortex with rather long and slender spines, and a persistent woody style; cortical fibers long and slender, not densely crowded, compacted under the style into a persistent hardened columella about 2 cm. long; pulp and mesocarp fibers only slightly developed, the latter forming a very thin fragile layer adherent to the surface of the nut; hilum surrounded by a prominent margin bearing the adhilum as a long slender spine. Collected in the Rio Fató Valley, near Nombre de Dios, Panama, August 16, 1911, by H. Pittier (No. 4230); type in U. S. National Herbarium, No. 691786.

Phytelephas brevipes. Trunk very short; male inflorescence about 15 cm. long; fruits broad and flat, or slightly depressed in the middle, 9 in a head, with 6 nuts in a fruit; cortex with rather coarse robust spines and rather short cortical fibers; pulp fibers distinct, but few; mesocarp fibers abundant, formed into a tough cloth-like sac entirely free from the nut and with an open space between; nuts rather large, usually strongly compressed; adhilum submarginal, transverse, triangular, carinate on the upper face. Collected at Gasapasabana, Upper Mamoni River, Panama, October, 1911, by H. Pittier (No. 4473); type in U. S. National Herbarium, No. 679633.

Phytelephas brachinus. Trunk robust, decumbent, attaining a length of about 3 meters and a diameter of about 40 cm.; fruits somewhat rounded or lenticular, scarcely depressed in the middle, but sloping to the sides, 5–6 in a head, with 5–6 nuts in each fruit; cortex with rather small slender spines, cortical fibers very short and weak; pulp fibers slender and sparse; mesocarp fibers very delicate and weak, but forming a rather tough, parchment-like membrane adherent to the bony endocarp; nuts short and with the upper surface sloping outward; hilum small, oval or elliptic, not prominent, with a cluster of small rounded pits near the middle; adhilum represented by a small rounded triangular prominence. Collected at Garachiné, San Miguel Bay, near the south coast of Panama, by H. Pittier; type in U. S. National Herbarium, No. 691785.

Phytelephas brachelus. Fruits obconic or obpyramidal, with a strong central depression, 9 in a head, with 6–7 nuts in each fruit; cortex with very short spines, about 0.5 cm.; cortical fibers well developed, attaining a length of about 1 cm.; pulp and mesocarp fibers thin, the latter

rather abundant and forming a rather thick, partly adherent covering of the endocarp; nuts rather long; hilum basal, somewhat prominent, nearly circular, with scattered coarse pits; adhilum represented by a slight swelling above the margin. Supposed to come from Panama, but the locality unknown. Fruit head received from J. R. Smith, Waterbury, Conn., in Economic Herbarium of U. S. Department of Agriculture, bearing U. S. National Herbarium No. 691784.

More extended descriptions with numerous photographic illustrations have been prepared for publication, in connection with a general review of the South American species.

BOTANY.—*A new genus of davallioid ferns.*[1] WILLIAM R. MAXON.

In revising the treatment of the pteridophyta for the second edition of the *Flora of the Southeastern United States* the writer has found it necessary to remove from the genus Odontosoria the species known latterly as *Odontosoria clavata* (L.) J. Smith and to refer it to a new genus, Sphenomeris. The publication of this volume having been delayed, it seems desirable to publish this name elsewhere, since a paper[2] dealing with the species of true Odontosoria (with references to Sphenomeris) is already in proof and may conflict in date of publication with that of the *Flora*.

In the unpublished treatment of Odontosoria just mentioned it is pointed out: (1) That the genus Odontosoria, as recognized by Diels in the Pflanzenfamilien of Engler and Prantl, comprises two sections or subgenera, the first (Eu-Odontosoria) containing rather small species of erect or ascending habit and determinate growth, the second (Stenoloma) containing three nominal species of indefinite scandent growth; (2) that these two groups are entitled to recognition as distinct genera; and (3) that, adopting this view, it is necessary to apply the name Odontosoria to the second group, the large climbing species, rather than to the first, as has been done erroneously by Diels. The grounds for this disposition are then presented, together with a review of the

[1] Published by permission of the Secretary of the Smithsonian Institution.
[2] Contr. U. S. Nat. Herb. **17**, part 2 (unpublished).

taxonomic history of Odontosoria in its broad sense and a revision of the American species now properly to be referred to that genus.

The group of species of upright or ascending habit and determinate growth, of which the *Odontosoria clavata* of authors is a familiar example, has no valid name. It may be characterized briefly as follows:

Sphenomeris Maxon, gen. nov.

Mainly tropical ferns, with slender creeping hairy rhizomes. Fronds subfasciculate, erect or ascending, of small or medium size; stipes not jointed to the rhizome; lamina 3 or 4 times obliquely pinnate or pinnatifid, the divisions alternate, the ultimate segments strongly cuneate; veins free. Sori terminal at or near the truncate apex of the segments, single or 2 to 4 joined; indusia similar in texture to the opposed leaf-margin, flattish, pocket-like, attached at the base and sides, single at the clavate apices of the veins or, if joined, borne upon a translucent receptacle connecting these.

The type species and apparently the sole American representative of this genus is:

Sphenomeris clavata (L.) Maxon
Adiantum clavatum L. Sp. Pl. 1096. 1753.
Davallia clavata J. E. Smith, Mem. Acad. Turin **5**: 415. 1793.
Stenoloma clavatum Fée, Gen. Fil. 330. 1852.
Lindsaya clavata Mett. Ann. Sci. Nat. IV. **15**: 64. 1861.
Schizoloma clavatum Kuhn, Chaetop. 346. 1882.

A large series of specimens of *S. clavata* is at hand from southern peninsular Florida, the Bahamas, Cuba, Porto Rico and Jamaica.

Two common Old World species may also be mentioned: **Sphenomeris retusa** (*Davallia retusa* Cav.) and **Sphenomeris chinensis** (*Adiantum chinense* L.), both agreeing closely with *S. clavata* in habit.

HELMINTHOLOGY.—*Draconema: A remarkable genus of marine free-living nematodes.* N. A. COBB, Bureau of Plant Industry, Communicated by Frederick V. Coville.

Few nematodes, if any, are more remarkable than Draconema. From a comparative anatomical point of view it takes rank with the bifurcated Lepidonema. The main features of Draconema are illustrated in the adjacent cut. Though the head end is very peculiar, all its peculiarities are more or less comprehensible. While the cephalic setae, amphids, mouth, oesophagus, and cardia, all present singular features, yet these features are referable to known types of nematode anatomy. Even the sudden loss in diameter behind the oesophagus, tho unique, is understandable on the supposition that unusual flexibility is required in this region owing to some odd habit of life.

In contemplation of the remainder of the anatomy, however, one becomes lost in amazement, and can only speculate on the nature and function of the complicated longitudinal series of lateral and subventral appendages. These appendages are found fully developed on both sexes, young or adult, and must, therefore, have to do with functions exercised at various stages of growth, and without regard to sex.

As we know little of the habits of Draconema beyond the fact that it occurs on or near red marine algae of strands in various parts of the world, speculation concerning the functions of its peculiar organs may be idle. One might suggest that the form of the body indicates possibly that the species inhabit tubes, which they may be imagined to construct, or which they may find already constructed and adapt to their uses. The existence of such a dwelling would harmonize with the expanded head and with the slimness of body behind the neck. Supposing the head end to be thrust out of the tubular home, the advantages of a limber body in seeking food can be readily understood. So too, the series of tubular organs might fit in with such a confined habit of life, and have to do with the construction and repair of the supposed tube; or with locomotion; or with aëration, by producing currents of fresher water inside the tube.

Of great interest also are the adjacent associated internal ventral organs, the details of which suggest the discharge of important functions. These internal structures are rich in chromatin. Their number and distribution indicate that in some way they are definitely connected with the tubular organs.

From a scientific standpoint it is especially desirable that further observations be made on this remarkable nematode.

The following notes relate to the suggested type species of this new genus.

Draconema cephalata, n. sp. $\frac{2.\ \ 5.3\ \ 12.\ \ -M^{77}\ \ 92.2}{3.9\ \ 5.1\ \ 2.2\ \ 4.8\ \ 2.2}$ 1.5 mm. The transparent, colorless layers of the cuticle are traversed by 800 to 900 plain transverse striae. The striae are rather uniformly fine on the body, but are much coarser on the anterior half of the neck, tho they suddenly cease on the head just behind the amphids.[1]

The fusiform neck ends in a rounded head, set off by the absence of striations. The mouth opening, it would appear, is surrounded by six forward-pointing lips, somewhat longer than they are wide, each rounded in front and supported by a forward-projecting pair of slender chitinous ribs. It is possible that the lips are three in number, and each two-parted. In any case they are so grouped as to form an elevated area on the middle of the head, and are surrounded by six short, forward-pointing setae, having a length about equal to the width of one of the wide cervical annules. The non-striated portion of the head bears numerous arcuate forward-pointing setae of variable size, the largest being half as long as the neck is wide, while the shortest are not very much longer than the minute labial setae already described. The amphids are shaped like the end of a shepherd's crook. Their anterior margins lie close to the lips, their posterior portions near the beginning of the striations. Measured crosswise at the widest part they have a width nearly as great as that of the group of lips when these latter are closed. All the more prominent cephalic setae are on the dorsal side of the head. On the dorsal side of the left amphid, near the striations, there is a pair of stout setae

[1] Proposed new term for the organs hitherto called "lateral organs."

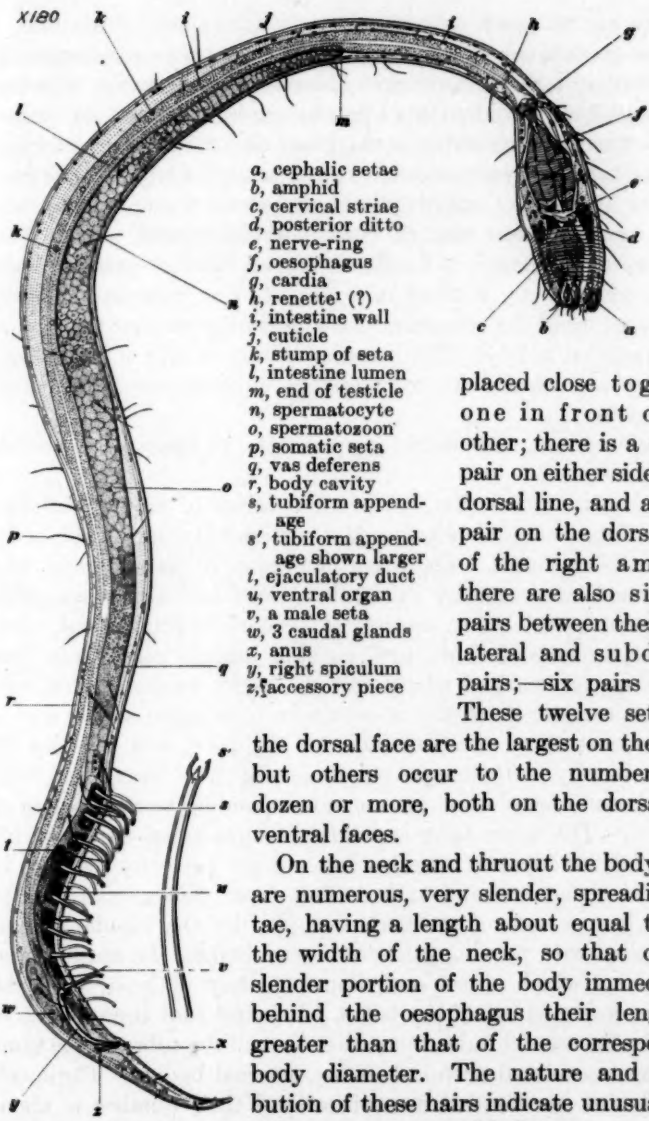

Fig. 1. *Draconema cephalata*

placed close together one in front of the other; there is a similar pair on either side of the dorsal line, and another pair on the dorsal side of the right amphid; there are also similar pairs between these sublateral and subdorsal pairs;—six pairs in all. These twelve setae on the dorsal face are the largest on the head, but others occur to the number of a dozen or more, both on the dorsal and ventral faces.

On the neck and thruout the body there are numerous, very slender, spreading setae, having a length about equal to half the width of the neck, so that on the slender portion of the body immediately behind the oesophagus their length is greater than that of the corresponding body diameter. The nature and distribution of these hairs indicate unusual sensitiveness to external influences.

[1] Proposed new term for organ previously known as the "ventral gland."

There are no eyes.

When the lips are closed the pharynx appears as an elongated, narrow, irregularly fusiform cavity, reaching well into the anterior oesophageal bulb, and ending opposite the anterior cervical striations. The greatest width of the pharynx is about equal to the distance between two successive striations of the adjacent cuticle. Near its hind end it suddenly widens out a little and then contracts again. There are no traces of pharyngeal teeth. The oesophagus is somewhat dumbbell-shaped, and consists of two bulbs connected by a short tube one-third as wide as the neck. The structure of the oesophagus and head suggests that the mouth can be opened widely. The intestine is built of cells of such a size that few are required to complete the circumference—probably two to four.

There are no male ventral supplementary organs of the usual character.

It remains to describe the peculiar series of arcuate tubular organs, found on both sexes on the posterior portion of the body in front of the anus. There are four series of these organs; two lateral and two ventrally submedian. The lateral sets comprise nine pairs. Each organ consists of a colorless, transparent, non-staining, arcuate, hollow tube, curving slightly backwards, but on the whole arranged nearly at right angles to the ventral surface. The outer extremity of each tube is enlarged a little and is distinguished from the remainder of the tube, not only by its width, but by difference in structure, for it is somewhat bell-shaped, and has an axial portion corresponding to the tongue of the bell. The tubes have a diameter about equal to the width of one of the adjacent annules, but are not perfectly uniform in diameter thruout their length, in fact taper gently from base to tip. That portion of the body occupied by the tubular organs is supplied with peculiar internal ventral bodies, the number and position of which correspond, approximately at least, with the number and position of the tubes. It is not that there is one of these bodies to each tube, but rather that all the tubes in the same zone are associated with one of the internal bodies. These cellular bodies are ventral in position and their number is about nine.

The adult female of *Draconema cephalata* is unknown. Females of other undescribed species show the vulva as central and the internal female organs double, symmetrical and reflexed, the rather short ovaries reaching well back towards the vulva. The eggs in these other species are usually prolate and thin-shelled, and few in number, generally only one in each uterus, and appear to be deposited before segmentation begins.

Habitat. Marine algae, or sand at their base, shoal in Kingston Harbor, Jamaica; also the strand of a small island off Port Royal, Jamaica.

ABSTRACTS

Authors of scientific papers are requested to see that abstracts, preferably prepared and signed by themselves, are forwarded promptly to the editors. Each of the scientific bureaus in Washington has a representative authorized to forward such material to this journal and abstracts of official publications should be transmitted through the representative of the bureau in which they originate. The abstracts should conform in length and general style to those appearing in this issue.

PHYSICS.—*A simplified formula for the change in order of interference due to changes in temperature and pressure of air.*[1] IRWIN G. PRIEST. Bulletin Bureau of Standards, vol. 9, in Press.

The author developed independently for use at the Bureau of Standards the following correction formula:

$$K=\left(\frac{b_1}{1+t_1}-\frac{b_2}{1+\alpha t_2}\right)\cdot l\cdot\left(\frac{\mu-1}{380\lambda}\right)$$

where t_1 = lower temperature Centigrade, t_2 = higher temperature Centigrade, b_1 = pressure in mm. of mercury at temperature t_1, b_2 = pressure in mm. of mercury at temperature t_2, l = distance between mirrors, μ = refractive index at 0°, 760 mm., α = coefficient of expansion of air, λ = wave length.

He noticed later that the formula published by Pulfrich,[2] viz:

$$K=l(t_2-t_1)\frac{b_2}{760}\cdot\frac{1}{1+\alpha t_1}\cdot\frac{1}{1+\alpha t_2}\left[\frac{2(\mu-1)\alpha}{\lambda}\right]-l(b_2-b_1)\cdot\frac{1}{1+\alpha t_2}\left[\frac{2(\mu-1)}{760\lambda}\right]$$

could be reduced to this simpler and more convenient form. The derivation of the new formula is given and the two formulas are compared as to convenience in practice. I. G. P.

[1] To understand this abstract the reader must see first Pulfrich. Zeit. für Inst. K. **13**: 456.

[2] The sign in Pulfrich's paper is in error if the expression is to give the *correction* not the *error*.

PHYSICS.—*Note on the calibration of optical pyrometers.* PAUL D. FOOTE. Metallurgical and Chemical Engineering, **11**: 97. 1913.

This note is a suggestion of a method for the calibration or checking of optical pyrometers. The only new feature is the construction of the "black body" upon which the pyrometers are sighted. A small enclosure, turned on the end of a graphite conical tube, dips into a graphite crucible containing 1000 to 1500 grams of molten metal, the pot being heated within an electric resistance furnace. Melting and freezing curves show the proper value to assign to the pyrometer reading, the flat part of the curves corresponding to the temperature of melting or of freezing. P. D. F.

MINERALOGY.—*A study of the tourmaline group.* WALDEMAR T. SCHALLER. Zeits. f. Krystallographie und Mineralogie, **51**: 321–343. 1912.

Analyses of tourmalines from Elba and California are given as well as their crystallographic constants, densities and refractive indices. The correlation of the physical and chemical properties is undertaken and by using also the available published data, the following conclusions are reached: (1) The general formula proposed by Penfield and Foote, namely $H_{20}B_2Si_4O_{21}$, is confirmed. (2) Some analyses do not give enough water to yield the ratio 12 $SiO_2.4H_2O$ but only 12 $SiO_2.3H_2O$. (3) The phenomenon of solid solution (as distinct from isomorphous mixture) does not play any role in tourmaline. (4) The percentages of Al_2O_3 and RO vary reciprocally in direct proportion. (5) The mineral tourmaline can not be represented by two, three or four definite formulas. General formulas can be deduced but at least four are required. The number of definite formulas or components, as they may be called, is large, not less than eight and probably more. (6) The crystallographic and physical properties vary in relation to the changes in chemical composition but the trustworthy data available are too meager for an exact correlation. Nevertheless all the determined changes are always in the same direction and approximately of the same order of magnitude, as shown by the diagrams in the original paper. Those tourmalines containing about 35 to 36 per cent Al_2O_3 show the maximum specific gravity, refractive indices and double refraction and the longest *c*-axis. W. T. S.

MINERALOGY.—*The crystallography of natramblygonite.* WALDEMAR T. SCHALLER. Zeits. f. Krystallographie und Mineralogie, **51**: 246–247. 1912.

Crystals of natramblygonite ($Na[Al(OH,F)]PO_4$) from Cañon City, Colorado, are described. They are very close to those of amblygonite in their interfacial angles and show similar crystal forms. W. T. S.

ECONOMIC GEOLOGY.—*The commercial marbles of western Vermont.* T. N. DALE. Bulletin 521, U. S. Geological Survey, pp. 164 and index, 2 colored geological maps, with sections, views, diagrams and micro-drawings. 1912.

Altho this bulletin has to do mainly with the calcite and dolomite marbles it includes brief accounts of the Roxbury serpentine and the newly discovered chrome-mica schist marble of Shrewsbury. It comprises a brief manual on marble in general, an account of the local areal, structural and historical geology, and the economic application of stratigraphy and petrography to the marble industry. In the scientific part the origin of dolomite is discussed and new facts are adduced to show that altho dolomitization of $CaCO_3$ does occur some dolomite is probably of direct sedimentary origin. In the economic part the Vermont marbles are standardized as to texture by their average grain diameter by the Rosiwal method and are compared with various European marbles. All the marbles described are classified commercially and scientifically. There are also chapters on values, adaptations, marble machinery, the probable amount of unexplored marble in western Vermont, scientific prospecting for and the testing of marble. Three bibliographies of marble are given, scientific, economic, and local, also a glossary of technical terms. T. N. D.

HEREDITY.—*Heredity and cotton breeding.* O. F. COOK. Bulletin 256, Bureau of Plant Industry, pp. 113, 6 plates, 19 text figures. 1913.

This bulletin attempts to present a more concrete conception of the nature of heredity, and to utilize this conception in the elucidation of practical breeding problems. Many current ideas of heredity derived from the study of self-fertilized plants are not applicable to normally open-fertilized types like cotton and corn. In dealing with such plants the "pure line" conception of heredity as represented by a condition of uniformity and stability of characters should give place to a recognition of diversity and free interbreeding as the normal antecedent condition of heredity and of evolutionary progress.

The uniformity of pure bred groups is an artificial result of restriction of descent to single or narrow lines, not a return to an original stage of purity and uniformity. Selection should be considered as a means of regulating the expression of characters, not of eliminating characters from transmission. Continued selection is necessary to maintain uniformity of expression in improved stocks.

A fundamental distinction between transmission and expression is recognized. The study of heredity, as far as it is concerned with the actual variation of plants and animals, is the study of expression relations. Investigations of heredity instead of being directed so largely to the discovery of the mechanism of transmission should seek first to understand the relations that govern expression. As a step in this direction names are proposed for some of the more important expression relations. When the expression of one character depends upon or conduces to the expression of another character the relation is called "symphanic." When the expression of one character inhibits or interferes with the expression of another the relation is called "antiphanic." When the expression of one character neither favors nor interferes with the expression of another the relation is called "paraphanic."

Other relations of expression are shown by the different results secured in first generation hybrids. In some hybrids there is a blended or combined (mixophanic) expression of the contrasted characters. In other cases one of the parental characters is suppressed (hypophanic), allowing the opposed character to appear as dominant (epiphanic). When both of the parental characters are suppressed, so that a more primitive character appears, the result may be described as reversive or atavistic expression (palimphanic).

Attention is given to the influence of external conditions upon expression, and to the relation of expression to vigor and fertility, including intensification of characters in conjugate hybrids and degeneration in perjugate hybrids. Coherence in the expression of characters derived from the same parental stock is recognized as an obstacle to the formation of Mendelian combinations of characters of different species. Intermediate (metaphanic) expression of characters often involves sterility, not only in hybrids between species, but also in case of incomplete differentiation of specialized organs of the same plant. Thus in cotton bract-like leaves and leaf-like involucral bracts are often accompanied by sterility. The bulletin concludes with two summaries, one of general conclusions regarding the nature of heredity, the other of applications to methods of breeding. O. F. C.

PROCEEDINGS OF THE ACADEMY AND AFFILIATED SOCIETIES

THE WASHINGTON ACADEMY OF SCIENCES

The 81st meeting of the Washington Academy of Sciences, the fifteenth annual meeting, was held at the Cosmos Club, 8 p.m., January 16, 1913, with President F. V. Coville in the chair and 40 members present. The minutes of the previous annual meeting and of all subsequent meetings were read and approved. The reports of the officers, of the Auditing Committee and of the Editors of the Journal were also read and approved.

The report on the ballot by mail for officers for 1913 showed the following elections: President: O. H. TITTMAN; non-resident vice-presidents, JOHN MUIR, F. W. PUTNAM; Corresponding secretary, ARTHUR L. DAY;[1] recording secretary, W. J. HUMPHREYS; treasurer, ALFRED H. BROOKS; managers, class of 1916, VERNON BAILEY, FRED. EUGENE WRIGHT.

The newly elected president, Mr. O. H. Tittman, then took the chair.

The following were elected resident vice-presidents as nominated by the affiliated Societies: Anthropological Society, F. W. Hodge; Archaeological, Mitchell Carroll; Biological, E. W. Nelson; Botanical, Edgar Brown; Chemical, C. E. Waters; Engineers, G. W. Littlehales; Entomological, A. L. Quaintance; Foresters, W. B. Greeley;[2] Geological, T. W. Stanton; Historical, James Dudley Morgan; Philosophical, C. G. Abbot.[3]

On motion by Mr. F. V. Coville, Dr. F. W. Clarke was asked to address the Academy. In reply Dr. Clarke congratulated the Academy on its several activities, and especially on the excellence of its Journal and on its Exhibit of Apparatus, Methods and Results in the New National Museum, March 28, 1912. He also expressed the desire that a similar exhibit be held again this year.

On motion by Dr. L. A. Bauer a vote of thanks was extended to the Business Manager and to the Editors of the Journal for their splendid work of the past year.

The retiring president, Mr. F. V. Coville, then presented his address, *The formation of leaf-mold*, which appears in full in this Journal **3**: 77.

W. J. HUMPHREYS, *Recording Secretary.*

[1] Resigned. G. K. Burgess elected by Board of Managers, January 20, 1913.

[2] Elected by Board of Managers, January 20, 1913.

[3] Elected by Board of Managers, January 20, 1913.

THE ANTHROPOLOGICAL SOCIETY OF WASHINGTON

The 465th regular meeting of the Anthropological Society of Washington, was held in the National Museum at 4.30 p.m., January 21, 1913, the president, Mr. George R. Stetson, in the chair.

DR. TOM A. WILLIAMS read a paper on *The dream in the life of the mind.* Dr. Williams said trance, vision, ecstasy and disease delirium are closely allied to the dream state. The psychopathology of them all illuminates formerly uncomprehended diseases. In a dream (illustrated by a case) mental perturbation may crystallize, as it were, and lead to rampageous behavior. On the contrary dreams may be teleologically beneficial; as where a vision saved a young woman from suicide, as was the case also with Benvenuto Cellini.

They are more often a mere reproduction of former experiences more or less significant and more so in psychopathic individuals, such as in a young hysteric who dreamed of falling down wells, assassinations and death, all painful experiences of her childhood.

Dream-thought, apparently confused, is really significant of the mental trend of the individual, when properly analysed and interpreted. One dreams all the time, but recollects only that dreamed within seven minutes of waking. The form of dream can be determined by external stimuli. This is demonstrated in spite of its contradiction by some psychopathologists.

There was no discussion. The meeting then adjourned.

WM. H. BABCOCK, *Secretary.*

A special meeting of the Anthropological Society of Washington was held on February 4, 1913 at 4.30 p.m. in the National Museum, the president, Mr. George R. Stetson, in the chair.

DR. CLARK WISSLER, Curator of the Department of Anthropology in the American Museum of Natural History, New York, read a paper on *The doctrine of evolution and anthropology.* An attempt was made to distinguish between cultural phenomena on one hand and biological on the other. Especially to make clear that cultural phenomena are not inherited, tho the instinct to develop culture, or to invent, is most certainly inborn. It was suggested that the historical attitude of present-day anthropology should be taken as expressing the cultural point of view. Culture itself seems to be associated with habit complexes or constructs of the mind and not to be in any way innate or inborn, but to be an external affair, preserved and carried on entirely by learning. Cultures develop and have an evolution of their own, but since they are not inherited they cannot be considered parts of a biological development.

The psycho-physical mechanism of man is biological and innate and constitutes man's equipment for the production of cultures. Anthropology holds that the mechanism is general in so far as it is not limited to any particular culture, and that it enables the individual to practise any culture he may meet, tho not necessarily to equal degrees.

When we come to consider the biological theory of evolution we find that it applies to the psycho-physical mechanism but not to culture. For cultures we must have another point of view or theory and this in America, at least, is the historical or cultural conception. This conception is in general that cultural traits are the results of invention, a mental process, and their development or evolution is to be taken as a historical and psychological problem.

The paper was briefly discussed by Dr. Folkmar, Dr. Swanton and Dr. Hough.

WM. H. BABCOCK, *Secretary.*

THE GEOLOGICAL SOCIETY OF WASHINGTON

The 262d meeting was held in the Cosmos Club, December 11, 1912.

REGULAR PROGRAM

Presidential address—*Some variations in Upper Cretaceous stratigraphy:* T. W. STANTON. This address appears in full in this Journal **3**: 55. 1913.

The twentieth annual meeting was then held.

The reports of the Secretaries and Treasurer were read and accepted.

The following officers were elected for the year 1913: President, F. L. RANSOME; first vice-president, DAVID WHITE, second vice-president, ARTHUR KEITH; treasurer, SIDNEY PAIGE; secretaries, R. W. RICHARDS, FRANK L. HESS; Members-at-large-of-the-council, WM. C. ALDEN, ADOLPH KNOPF, C. E. SIEBENTHAL, P. S. SMITH, E. W. SHAW.

Dr. T. W. STANTON was nominated as candidate for the vice-presidency of the Washington Academy of Sciences to represent the Geological Society.

R. W. RICHARDS, *Secretary.*

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